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Health Monitoring and Management Using Internet-of-Things (IoT)

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Abstract ***Among the range of applications enabled by the Internet of Things (IoT), smart and connected health care is a particularly important one. Networked sensors, either worn on the body or embedded in our living environments, make possible the gathering of rich information indicative of our physical and mental health. Captured on a continual basis, aggregated, and effectively mined, such information can bring about a positive transformative change in the health care landscape. In particular, the availability of data at until now unimagined scales and temporal longitudes coupled with a new generation of intelligent processing algorithms can: (a) facilitate an evolution in the practice of medicine, from the current post facto diagnose-and treatre active paradigm, to a proactive framework for prediction of diseases at an early stage, cure,and overall management of health (b) help reduce the cost of health care while simultaneously improving outcomes. In this paper, we highlight the opportunities and challenges for IoT in realizing this vision of the future of health care at emergency.***

I. INTRODUCTION

Recent years have seen a rising interest in wearable sensors and today several devices are commercially available [1]–[3] for personal health care, fitness, and activity awareness. researchers have also considered applications of such technologies in clinical applications in remote health monitoring systems for long term recording, management and clinical access to patient's physiological information [4]–[8].Based on current technological trends, one can readily imaginea time in the near future when your routine physical examination is preceded by a two–three day period of continuous physiological monitoring using inexpensive wearable sensors.

Over this interval, the sensors would continuously record signals correlated with your key physiological parameters and relay the resulting data to a database linked with your health records. When you show up for your physical examination, the doctor has available not only conventional clinic/lab-test based static measurements of your physiological and metabolic state, but also the much richer longitudinal record provided by the sensors. Using the available data, and aided by decision support systems that also have access to a large corpus of observation data for other individuals, the doctor can make a much better prognosis for your health and recommend treatment, early intervention, and life-style choices that are particularly effective in improving the quality of your

health. Such a disruptive technology could have a transformative impact on global healthcare systems and drastically reduce healthcare costs and improve speed and accuracy for diagnoses.

Technologically, the vision presented in the preceding paragraph has been feasible for a few years now. Yet, wearable sensors have, thus far, had little influence on the current clinical practice of medicine. In this paper, we focus particularly on the clinical arena and examine the opportunities afforded by available and upcoming technologies and the challenges that must be addressed in order to allow integration of these into the practice of medicine.

Most proposed frameworks for remote health monitoring leverage a three tier architecture: a Wireless Body Area Network (WBAN) consisting of wearable sensors as the data acquisition unit, communication and networking and the service layer [4], [7]–[10]. For instance [11] proposes a system that recruits wearable sensors to measure various physiological parameters such as blood pressure and body temperature. Sensors transmit the gathered information to a gateway server through a Bluetooth connection. The gateway server turns the data into an Observation and Measurement file and stores it on a remote server for later retrieval by clinicians through the Internet.

Utilizing a similar embedded web server based medical data storage, a health monitoring system is presented in [12] in which medical staff can access the stored data online through content service application. Targeting a specific medical application, an end to end remote health monitoring and analytics system is presented for supervision of patients with high risk of heart failure. In addition to the technology for data gathering, storage

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and access, medical data analysis and visualization are critical components of remote health monitoring systems. Accurate diagnoses and monitoring of patient's

II. EMBEDDED WEB SERVER

Embedded web server (fig1) consist of ARM processor. ARM processor is deployed with linux OS and web server application is configured with OS,that is both the OS and web server applications are ported on ARM 11. The embedded web server includes complete web server with TCP/IP support.TCP/IP protocol suite allows computers running different OS, to communicate with each other, it forms the basis for worldwide internet.

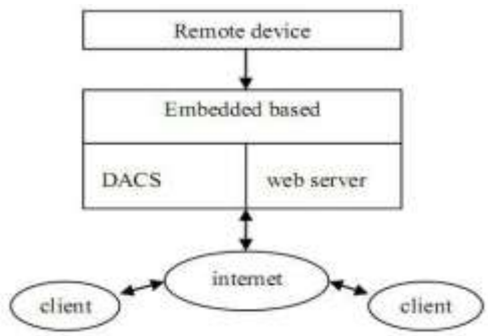
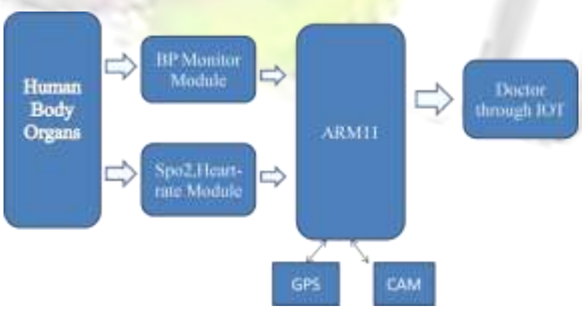


Figure 1:embedded web server

The general block diagram of real time remote data acquisition using msp430 processor and ARM11 board as a Server base station (fig2). Doctor can access the real time data through internet.



a) BP monitoring module:

- BP is one of the vital signs in human body
- This paper demonstrates how to build noninvasive BP monitor using mpx 2050(fig.3) blood pressure sensor and ARM11.

medical condition relieson analysis of medical records containing various physiological characteristics over a longperiodoftime.

Figure 3: Mpx 2050 sensor

Noninvasive method measures arterial systolic and diastolic pressure of human body [3].

- Noninvasive method of monitoring BP used is oscillometric method

b) pulse oximeter module :

Easy Pulse is a DIY pulse sensor that is designed for hobbyist and educational applications to illustrate the principle of photoplethysmography (PPG) as a non- invasive technique for detecting the cardio-vascular pulse wave from a fingertip. The current version (V1.1) of Easy Pulse uses a transmission mode PPG probe (HRM-2511E) sensor, which uses an infrared light source to illuminate the finger on one side, and a photo detector on the other side to measure small variations in the transmitted light intensity due to changes in blood volume inside the tissue. The on board instrumentation provides a clean and filtered analog PPG waveform as well as a digital pulse output, which are both synchronous with the heart beat.

c) ARM 11 :

- HDMI (High Definition Multimedia Interface) supports high-quality digital video and audio through a single cable.
- Touchscreens and smaller LCD displays will be supported via the DSI (Display Serial Interface) header connection.
- Sd card is ported with linux OS, application specific software,tcp/ip protocol which will act as embedded web server.
- Usb wireless for wifi connection,wired Ethernet, USB Bluetooth adapter,USB soundcards,camera serial interface.

d) Heart rate through Fingertip:

Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. This project describes a technique of measuring the heart rate through a fingertip using a PIC microcontroller. While the heart is beating, it is actually pumping blood throughout the body, and that makes the blood volume inside the finger artery to change too. This fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. The signal can be amplified further for the microcontroller to count the rate of fluctuation, which is actually the heart rate.**V. ALGORITHM:**

A) PULSEOXIMETER:
pulse oximeter measures oxygen saturation.oxygen saturation refers to percentage of available haemoglobin that carries oxygen.

1) Oxygen enters the lungs and is passed on to blood
2) The main way the oxygen is carried in our blood is by haemoglobin
3) Haemoglobin without oxygen is deoxygenated hb. and oxygen with haemoglobin is called as oxygenated hb
4) Oxyhaemoglobin absorbs more infrared light then red light .Deoxyhaemoglobin absorbs more red light then infrared light as shown in (fig8)
5) Haemoglobin absorbs light.The amount of light absorbed is proportional to the concentration of hb.
6) The pulse oximeter works out the oxygen saturation by comparing how much red light and infrared light is absorbed by blood

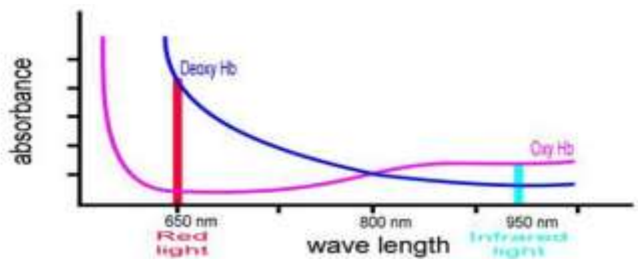
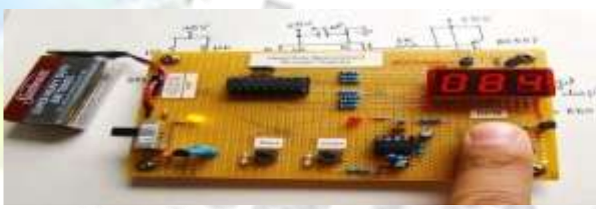


Figure8: graph of absorbance of light vs wavelength

B) BLOOD PRESSURE

1) Run the air pump until pressure in the cuff is greater than the typical systolic pressure
2) It is then deflated. The pressure starts decreasing, resulting in blood flow through the artery, this make the artery to pulsate.
3) The pressure measured on the device during onset of pulsation defines the systolic blood pressure.
4) Then the cuff pressure is reduced further. The oscillations becomes increasingly significant fig (9), until they reach maximum amplitude.
5) The pressure at the maximum amplitude of these oscillations define the average blood pressure
6) The oscillations start decreasing as the cuff pressure reduces. The pressure at this point defines the diastolic blood pressure



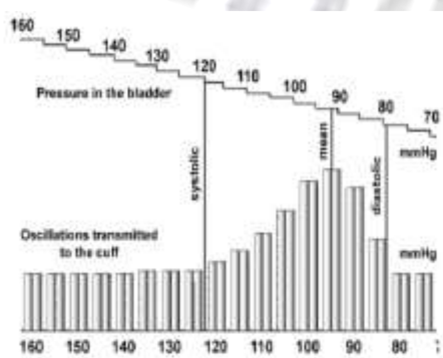


Figure9: graph showing principle of systolic and diastolic BP patient is in a situation that he cant visit the doctor but has to tell the situation to the doctor he can communicate with the doctor by using video communication platform which is one of the external peripherals of the system

VI. RESULT AND DISCUSSION:

Physiological data is acquired by wearable device that combine miniature sensors capable of measuring various physiological parameters, minor preprocessing hardware and a communications platform for transmitting the measured data.

The Physiological data which is acquired by wearable device is collected by the arm11 and undergoes some changes according to the system and stored in the database using the IOT and where the doctor can check the details or retrieve the details of that particular person using Id which is defined in the database so When the patient is in a certain medical emergency Like the person is met with a heart attack then the wearable device with the patient detect this abnormal changes in the body by measuring the heart beat rate, the technique here we are using is that we predefine the arm11 system that what should be the actual heart beat rate to be and up to what rate it can be maintain a max and min value If the reading reaches below or above that defined value then the processor indicates an emergency alert to the Prescribed number using dtmf and to the doctor indicating the emergency alert message with the name and the id ,not only alerting the doctor it sends the gps location of that particular person,and also to the nearest ambulance. So, that the patient can be provided with the best treatment by concerning with the corresponding regular doctor and treatment can be started soon without wasting the time for doing the regular tests like whether he has sugar, bp, what is his blood group etc., this can be avoided and the present treating doctor can take suggestions from him and continue the treatment ,by doing this the rate of risk will be reduced and the patient will be safe .

In the regular cases the patient can periodically update his basic health checkups by using this system and can give the update to the doctor and take necessary prescription from him. In case if the The low energy operation requirement can also pose a challenge for the quality of the data captured in terms of the achievable signal to noise ratio. Recent designs [5], [29],[30] of flexible sensors that can be placed in contact with the skin in different body parts are particularly attractive for medical applications because, compared to alternatives, the close contact with the skin allows measurement of more physiological parameters and with greater accuracy. There have also been efforts to prolong the operational lifetime of wearable sensors by incorporating low power device and circuit level techniques [31], [32] and energy harvesting methods [33] .Moreover, utilizing intelligent sensing methods on system level can further increase the operational longevity.

Although the sensor deployment in our health monitoring system is more concentrated compared to WSNs, existing methods for WSNs can be revisited to suit our needs. The proposed energy efficient sensing approaches revolve around assigning sensing tasks to the nodes based on their relative distance so as to sense the maximum amount of physical information while minimizing the energy consumption by removing possible redundant sensing tasks [34], [35] and by allocation of tasks based on the energy availability at each sensor [36].

To further realize the IoT concept, IPv6 over Low Power Wireless Personal Area Networks (6LoWPAN) has been proposed to seamlessly connect energy constrained WPAN devices to the Internet [19]. 6LoWPAN defines fragmentation techniques to fit IPv6 datagrams into IEEE 802.15.4 limited frame size to provide IP access to low power, low complexity sensing devices.

As this is a medical application, reliability is needed in first place. so to achieve the reliability the main

attention were given to following points:
1) Accurate collaboration
2) Maintaining low noise floor
3) Getting data in real time and processing it.
4) Reliability of communication infrastructure

CONCLUSION:

This project allows real time continuous monitoring of patient by medical expert from anywhere in the world and handle emergencies. With the approach and studying of different developing platforms like cypress, free scale, texas instrument, and according to requirements and by calibration most suitable elements were chosen and the final design was created. and to work out with this design various suitable hardware and software tools were used.

FUTURE SCOPE:

Project can be extended by connecting the database management to the cloud so that wherever in this world the doctor can access the data of the patient which is said to be the most evolving technology with the iot and also by introducing a separate application so that doctor , the patient and the module all will come into single platform.

REFERENCES

[1] Jawbone Inc., “Jawbone fitness trackers,” accessed April 2015. [Online]. Available: https://jawbone.com/up/trackers
[2] FitBit Inc., “flex: Wireless activity + sleep wristband,” accessed April 2015. [Online]. Available: https://www.fitbit.com/flex
[3] Apple Inc., “Apple watch,” accessed April 2015.[Online]. Available: https://www.apple.com/watch/
[4] A. Pantelopoulos and N. Bourbakis, “A survey on wearable sensor-based systems for health monitoring and prognosis,” IEEE Trans. Sys., Man, and Cybernetics, Part C: Applic. and Reviews, vol. 40, no. 1, pp. 1–12, Jan 2010. [5] D. Son, J. Lee, S. Qiao, R. Ghaffari, J. Kim, J. E. Lee, C. Song, S. J. Kim, D. J. Lee, S. W. Jun, S. Yang, M. Park, J. Shin, K. Do, M. Lee, K. Kang, C. S. Hwang, N. Lu, T. Hyeon, , and D.-H. Kim, “Multifunctional wearable devices for diagnosis and therapy of movement disorders,” Nature Nanotechnology, pp. 1–8, 2014.
[6] A. Page, O. Kocabas, T. Soyata, M. Aktas, and J.-P. Couderc, “Cloud- Based Privacy-Preserving Remote ECG Monitoring and Surveillance,” Annals of Noninvasive Electrocardiology (ANEC), 2014. [Online]. Available: http://dx.doi.org/10.1111/anec.12204
[7] R. Paradiso, G. Loriga, and N. Taccini, “A wearable health care system based on knitted integrated sensors,” IEEE Trans. Info. Tech. in Biomedicine, vol. 9, no. 3, pp. 337–344, Sept 2005.

[8] A. Milenkovi, C. Otto, and E. Jovanov, “Wireless sensor networks for personal health monitoring: Issues and an implementation,” Comput. Commun., vol. 29, no. 1314, pp. 2521 – 2533, 2006, wirelsess Senson Networks and Wired/Wireless Internet Communications. [Online]. Available:http://www.sciencedirect.com/science/article/pii/ S0140366406000508
[9] M. Bazzani, D. Conzon, A. Scalera, M. Spirito, and C. Trainito,“Enabling the IoT paradigm in e-health solutions through the VIRTUSmiddleware,” in IEEE 11th Int. Conf. on Trust, Security and Privacy inComputing and Com.(TrustCom), June 2012, pp. 1954–1959.
[10] A. Benharref and M. Serhani, “Novel cloud and SOA- based frameworkfor E-Health monitoring using wireless biosensors,” IEEE Journal ofBiomed. and Health Inf., vol.18, no. 1, pp. 46–55, Jan 2014.
[11] S. Babu, M. Chandini, P. Lavanya, K. Ganapathy, and V. Vaidehi, “Cloud-enabled remote health monitoring system,” in Int. Conf. on Recent Trends in Inform. Tech. (ICRTIT), July 2013, pp. 702–707.
[12] C. Rolim, F. Koch, C. Westphall, J. Werner, A. Fracalossi, and G. Salvador, “A cloud computing solution for patient’s data collection in health care institutions,” in Second Int. Conf. on eHealth, Telemedicine, and Social Medicine, ETELEMED ’10., Feb 2010, pp. 95–99. [13] M. Lan, L. Samy, N. Alshurafa, M.-K. Suh, H. Ghasemzadeh, A. Macabasco-O’Connell, and M. Sarrafzadeh, “Wanda: An end-to-end remote health monitoring and analytics system for heart failure patients,” in Proc. of the Conf. on Wireless Health, ser. WH ’12. New York, NY, USA: ACM, 2012, pp. 9:1–9:8.

[14] L. Wei, N. Kumar, V. Lolla, E. Keogh, S. Lonardi, C. Ratanamahatana, and H. Van Herle, "A practical tool for visualizing and data mining medical time series," in Proc. 18th IEEE Symposium on Computer-Based Med. Sys., June 2005, pp. 341–346.
[15] Y. Mao, Y. Chen, G. Hackmann, M. Chen, C. Lu, M. Kollef, and T. Bailey, "Medical data mining for early deterioration warning in general hospital wards," in IEEE 11th Int. Conf. on Data Mining Workshops (ICDMW), Dec 2011, pp. 1042–1049.
[16] V. Ukis, S. Tirunellai Rajamani, B. Balachandran, and T. Friese, "Architecture of cloud-based advanced medical image visualization solution," in IEEE Int. Conf. on Cloud Computing in Emerging Markets (CCEM), Oct 2013, pp. 1–5.
[17] B. Rao, "The role of medical data analytics in reducing health fraud and improving clinical and financial outcomes," in Computer-Based Medical Systems (CBMS), 2013 IEEE 26th International Symposium on, June 2013, pp. 3–3.
[18] P. Ray, "Home health hub internet of things (H3IoT): An architectural framework for monitoring health of elderly people," in Int. Conf. on Science Eng. And Management Research (ICSEMR), Nov 2014, pp. 1–3.
[19] N. Bui and M. Zorzi, "Health care applications: A solution based on the internet of things," in Proc. of the 4th Int. Symposium on Applied Sciences in Biomed. and Com. Tech., ser. ISABEL '11. New York, NY, USA: ACM, 2011, pp. 131:1–131:5.
[20] W. Zhao, C. Wang, and Y. Nakahira, "Medical application on internet of things," in IET Int. Conf. on Com. Tech. and Application (ICCTA 2011), Oct 2011, pp. 660–665.
[21] F. Hu, D. Xie, and S. Shen, "On the application of the internet of things in the field of medical and health care," in IEEE Int. Conf. on and IEEE Cyber, Physical and Social Computing Green Computing and Communications (GreenCom),(iThings/CPSCom), Aug 2013, pp. 2053–2058.
[22] T. Soyata, R. Muraleedharan, C. Funai, M. Kwon, and W. Heinzelman,"Cloud-Vision: Real-Time face recognition using a Mobile-Cloudlet-Cloud acceleration architecture," in Proceedings of the 17th IEEESymposium on Computers and Communications (IEEE ISCC 2012),Cappadocia, Turkey, Jul 2012, pp. 59–66.
[23] G. Nalinipriya and R. Aswin Kumar, "Extensive medical data storagewith prominent symmetric algorithms on cloud - a protected framework,"in IEEE Int. Conf. on Smart Structures and Systems (ICSSS), March 2013, pp. 171–177.
[24] A. F. M. Hani, I. V. Paputungan, M. F. Hassan, V. S.Asirvadam, and M. Daharus, "Development of private cloud storage for medical image research data," in Int.Conf. on Computer and Inf. Sciences (ICCOINS), June 2014, pp.1–6.
[25] "World health organization factsheeets: Cardiovascular diseases (CVDs)," online, accessed April 2015. [Online]. Available: http://www.who.int/mediacentre/factsheets/fs317/en/
[26] "World health organization factsheeets: Chronic obstructive pulmonary disease (COPD)," online, accessed April 2015. [Online]. Available: http://www.who.int/mediacentre/factsheets/fs315/en/
[27] "Parkinson's diseast information (mayo clinic website)," online, accessed April 2015. [Online]. Available: http://www.mayoclinic.org/ diseases- conditions/parkinsons-disease/basics/definition/con- 20028488
[28] E. Dorsey, R. Constantinescu, J. Thompson, K. Biglan, R. Holloway, K. Kieburtz, F. Marshall, B. Ravina, G. Schifitto, A. Siderowf et al., "Projected number of people with Parkinson disease in the most populous nations, 2005 through 2030," Neurology, vol. 68, no. 5, pp. 384–386, 2007.
[29] S. Xu, Y. Zhang, L. Jia, K. E. Mathewson, K.-I. Jang, J. Kim, H. Fu, X. Huang, P. Chava, R. Wang, S. Bhole, L. Wang, Y. J. Na, Y. Guan, M. Flavin, Z. Han, Y. Huang, and J. A. Rogers, "Soft microfluidic assemblies of sensors, circuits, and radios for the skin," Science, vol. 344, pp. 70–74, 2014.
[30] D.-H. Kim, R. Ghaffari, N. Lu, and J. A. Rogers, "Flexible andstretchable electronics for biointegrated devices," Annual Review of Biomedical Engineering, pp. 113–128, 2012.
[31] O. Olorode and M. Nourani, "Reducing leakage power in wearable medical devices using memory nap controller," in Circuits and Sys. Conf. (DCAS), IEEE Dallas, Oct 2014, pp. 1–4.
[32] C. Park, P. Chou, Y. Bai, R. Matthews, and A. Hibbs, "An ultra-wearable, wireless, low power ecg monitoring system," in Biomed.l Circuits andSys. Conf., BioCAS 2006. IEEE, Nov 2006, pp. 241–244.291